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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/796,514	03/09/2004	John P. Snyder	6932.14467.05	1961
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EXAMINER				
KIM, S U C				
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2823				
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary

Application No.

10/796,514

Applicant(s)

SNYDER ET AL.

Examiner

SU C. KIM

Art Unit

2823

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 24 November 2008.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-8, 10-21, 23-31 and 33-65 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-8, 10-21, 23-31 and 33-65 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 09 March 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date _____
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date _____
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: _____

Response to Arguments

1. Applicant's arguments, see applicant argument (pages 14-19), filed on 11/24/2008, with respect to the rejection(s) of claim(s) 1-8, 10-21, 23-31, & 33-65 under 35 U.S.C 102(b) have been fully considered and are persuasive. Therefore, the rejection has been withdrawn. However, upon further consideration, a new ground(s) of rejection is made in view of Gardner et al. (US 6,207,995) in view of MAEDA et al. (US 2001/0045602).

2. Applicant' argument With respect to claims rejection under 35 U.S.C. 112 2nd paragraph, applicant argues that "thin film recited in claims 33, 34 and 55 , which is a well known term in the art and would be understood by a person of skill in the art"

The term "thin film" in claim 33, 34 and 55 is a relative term which renders the claim indefinite. The term "thin" is not defined by the claim, the specification does not provide a standard for ascertaining the requisite degree, and one of ordinary skill in the art would not be reasonably apprised of the scope of the invention. Therefore, the examiner maintains rejection because how thin film is not defined in the written disclosure.

Claim Rejections - 35 USC § 112

3. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

The term "thin film" in claims 33, 34, 44, 45, 55, & 56 are a relative term which renders the claim indefinite. The term "thin" is not defined by the claim, the specification

does not provide a standard for ascertaining the requisite degree, and one of ordinary skill in the art would not be reasonably apprised of the scope of the invention.

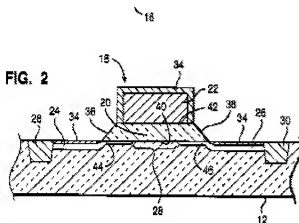
Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
 2. Ascertaining the differences between the prior art and the claims at issue.
 3. Resolving the level of ordinary skill in the pertinent art.
 4. Considering objective evidence present in the application indicating obviousness or nonobviousness.
5. Claims 1-4, 6-8, 10, 12, 14-18, 20-21, 23-27, 29-31, 34, 44, & 55 are rejected under 35 U.S.C. 103(a) as being unpatentable over Gardner et al. (US 6,207,995) in view of MAEDA et al. (US 2001/0045602).



Regarding claims 1, 15, & 24, Gardner discloses that a method of manufacture of a device for regulating the flow of electrical current, the method comprising:

providing for a semiconductor substrate 12 (Fig. 2);

providing for an electrically insulating layer 38 in contact with the semiconductor substrate 12 (Fig. 2), the insulating layer having a dielectric constant greater than 4.0, 7.6, or 15 (col. 5, lines 15-25, note: a dielectric constant of TiO₂ is approximately 50-60);

providing for a gate electrode 20 in contact with at least a portion of the insulating layer 38 (Fig. 2); and

proximal to the gate electrode 22 wherein a channel 28 is formed between the source and the drain 34, and further wherein at least one of the source and the drain forms a Schottky contact (note: silicide, or an ohmic contact which is a different name of Schottky contact) or Schottky-like region with the semiconductor substrate and channel (Fig. 2).

Gardner fails to teach providing a source electrode and a drain electrode in contact with the semiconductor substrate and at least one of the source electrode and

the drain electrode forms a Schottky contact or Schottky-like region with the semiconductor substrate and channel.

However, MAEDA discloses that providing a source electrode 15 and a drain electrode 16 in contact with the semiconductor substrate 3 and at least one of the source electrode 15 and the drain electrode forms a Schottky contact 21 or Schottky-like region with the semiconductor substrate and channel 12 (Fig. 2).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of applicant(s) claimed invention was made to provide Gardner with providing a source electrode and a drain electrode in contact with the semiconductor substrate and at least one of the source electrode and the drain electrode forms a Schottky contact or Schottky-like region with the semiconductor substrate and channel as taught by MAEDA in order to complete device by providing electrical connection in source and drain.

Regarding claims 2-3, 16-17, & 25-26, as applied to claims 1, 15, & 24, Gardner and MAEDA in combinations disclose that the source and drain electrode are formed from a member of the group consisting of: platinum silicide, palladium silicide and iridium silicide (Col. 8, lines 11-19).

Regarding claims 4, 18, & 27, as applied to claims 1, 15, & 24, Gardner and MAEDA in combinations disclose the insulating layer is formed from a member of the group consisting of metal oxide (Col. 5, lines 15-25).

Regarding claims 6, 20, & 29, as applied to claims 1, 15, & 24, Gardner and MAEDA in combinations disclose the Schottky contact or Schottky-like region is formed at least in areas adjacent to the channel (Fig. 2).

Regarding claims 7, 21, & 30, as applied to claims 1, 15, & 24, Gardner and MAEDA in combinations disclose that an entire interface between at least one of the source electrode and drain electrode and the semiconductor substrate forms a Schottky contact 34 or Schottky-like region with the semiconductor substrate (Fig. 2).

Regarding claims 8, 23, & 31, as applied to claims 1, 15, & 24, Gardner and MAEDA in combinations disclose that dopants are introduced into the channel (col. 1, lines 14-15, note: substrate is lightly doped).

Regarding claim 10, as applied to claims 2 or 3, Gardner and MAEDA in combinations disclose the insulating layer is formed from a member of the group consisting of metal oxide (Col. 5, lines 15-25).

Regarding claim 12, as applied to claims 2 or 3 Gardner and MAEDA in combinations disclose the Schottky contact or Schottky-like region is formed at least in areas adjacent to the channel (Fig. 2).

Regarding claim 14, as applied to claims 2 or 3, Gardner and MAEDA in combinations disclose providing a source electrode and a drain electrode 34 in contact with the semiconductor substrate 12 is performed at a processing temperature of less than about 800 °C (col. 8, lines 12-18).

Regarding claims 33, 44, & 55, Gardner and MAEDA in combinations disclose a method for manufacture of a device for regulating the flow of electrical current, the method comprising:

providing for a semiconductor substrate 12 (Fig. 2);

providing for an electrically insulating layer 38 in contact with the semiconductor substrate 12 (Fig. 2), the insulating layer having a dielectric constant greater than 4.0, 7.6, or 15 (col. 5, lines 15-25, note: a dielectric constant of TiO_2 is approximately 50-60);

providing for a gate electrode 20 in contact with at least a portion of the insulating layer 38 (Fig. 2);

exposing the semiconductor substrate on one or more areas proximal to the gate electrode;

providing for a thin film of metal on at least a portion of the exposed semiconductor substrate; and

reacting the metal with the exposed semiconductor substrate such that a source electrode and a drain electrode 34 formed and wherein a channel 28 is formed between the source and the drain 34 (Fig. 2, col 8, lines 4-40).

Gardner fails to teach providing a source electrode and a drain electrode in contact with the semiconductor substrate and at least one of the source electrode and the drain electrode forms a Schottky contact or Schottky-like region with the semiconductor substrate and channel.

However, MAEDA discloses that providing a source electrode 15 and a drain electrode 16 in contact with the semiconductor substrate 3 and at least one of the source electrode 15 and the drain electrode forms a Schottky contact 21 or Schottky-like region with the semiconductor substrate and channel 12 (Fig. 2).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of applicant(s) claimed invention was made to provide Gardner with providing a source electrode and a drain electrode in contact with the semiconductor substrate and at least one of the source electrode and the drain electrode forms a Schottky contact or Schottky-like region with the semiconductor substrate and channel as taught by MAEDA in order to complete device by providing electrical connection in source and drain.

6. Claims 34-39, 41-43, 45-50, 52-54, 56-61, & 63-65 are rejected under 35 U.S.C. 103(a) as being unpatentable over Gardner et al. (US 6,207,995) in view of MAEDA et al. (US 2001/0045602) and further in view of Su et al. (US 5,208,472).

Regarding claims 34, 45, & 56, as applied to claims 33, 44, & 55, Gardner and MAEDA in combinations disclose that depositing a thin conductive film 50 on the insulating layer 48 (Fig. 3);

patterning and etching the conductive film to form a gate electrode 22 (Fig. 4 & 5).

Gardner fails to teach forming one or more thin insulating layers on one or more sidewalls of the gate electrode.

However, Su discloses forming one or more thin insulating layers on one or more sidewalls 19 & 22 of the gate electrode 16 (Fig. 6).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of applicant(s) claimed invention was made to provide Gardner and MAEDA in combinations with forming one or more thin insulating layers on one or more sidewalls of the gate electrode as taught by Su in order to reduce shorting between the gate and

the source/drain region and decreases the damage induced by the stress of the silicide film (Col. 3, lines 6-8).

Regarding claims 35, 46, & 57, as applied to claims 33, 44, & 55, Gardner, MAEDA, and Su in combinations disclose that removing metal not reacted during the reacting process (Gardner, col. 8, lines 26-30).

Regarding claims 36, 47, & 58, as applied to claims 33, 44, & 55, Gardner, MAEDA, and Su in combinations disclose that the reacting comprising thermal annealing (Gardner, col. 8, lines 13-40).

Regarding claims 33-38, 48-49, & 59-60, as applied to claims 33, 44, & 55, Gardner, MAEDA, and Su in combinations disclose that the source and drain electrode are formed from a member of the group consisting of: platinum silicide, palladium silicide and iridium silicide (Gardner, col. 8, lines 11-19).

Regarding claims 39, 50, & 61, as applied to claims 33, 44, & 55, Gardner, MAEDA, and Su in combinations disclose that the insulating layer is formed from a member of the group consisting of metal oxide (Gardner, col. 5, lines 15-25).

Regarding claims 41, 52, & 63, as applied to claims 33, 44, & 55, Gardner, MAEDA, and Su in combinations disclose that the Schottky contact or Schottky-like region is formed at least in areas adjacent to the channel (Gardner, Fig. 2).

Regarding claims 42, 53, & 64, as applied to claims 33, 44, & 55, Gardner, MAEDA, and Su in combinations disclose that an entire interface between at least one of the source electrode and drain electrode and the semiconductor substrate forms a

Schottky contact 34 or Schottky-like region with the semiconductor substrate (Gardner, Fig. 2).

Regarding claims 43, 54, & 65, as applied to claims 33, 44, & 55, Gardner, MAEDA, and Su in combinations disclose that dopants are introduced into the channel (Gardner, col. 1, lines 14-15, note: substrate is lightly doped).

7. Claims 5, 11, 13, 19, & 28 are rejected under 35 U.S.C. 103(a) as being unpatentable over Gardner et al. (US 6,207,995) in view of MAEDA et al. (US 2001/0045602) and further in view of Buchanan et al. (US 6,245,616).

Regarding claim 5, 11, 19, 28, as applied to claims 5, 2 or 3, 15, & 24, Gardner and MAEDA in combinations disclose the insulating layer 20 (Gardner).

Gardner and MAEDA in combinations fail to teach the insulating layer is formed from an oxy-nitride stack.

However, Buchanan suggests that the insulating layer is formed from an oxy-nitride stack 20 (Fig. 1).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of applicant(s) claimed invention was made to provide Gardner and MAEDA in combinations with the insulating layer is formed from an oxy-nitride stack as taught by Buchanan in order to reduce channel hot electron damage (col. 1, lines 14-15).

Regarding claim 13, as applied to claim 11, Gardner, MAEDA, and Buchanan in combinations disclose that the Schottky contact or Schottky-like region is formed at least in areas adjacent to the channel (Gardner, Fig. 2).

8. Claims 40, 51, & 62 are rejected under 35 U.S.C. 103(a) as being unpatentable over Gardner et al. (US 6,207,995) in view of MAEDA et al. (US 2001/0045602) and further in view of Su et al. (US 5,208,472) and Buchanan et al. (US 6,245,616).

Regarding claim 40, 51, & 62, as applied to claims 33, 44, & 55, Gardner, MAEDA and Su in combinations disclose the insulating layer 20.

Gardner, MAEDA and Su fail to teach the insulating layer is formed from an oxy-nitride stack.

However, Buchanan suggests that the insulating layer is formed from an oxy-nitride stack 20 (Fig. 1).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of applicant(s) claimed invention was made to provide Gardner, MAEDA and Su with the insulating layer is formed from an oxy-nitride stack as taught by Buchanan in order to reduce channel hot electron damage (col. 1, lines 14-15).

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to SU C. KIM whose telephone number is (571)272-5972. The examiner can normally be reached on Monday - Friday, 10:00AM to 6:00PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Matthew S. Smith can be reached on (571) 272-1907. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/SU C KIM/
Examiner, Art Unit 2823

/W. David Coleman/
Primary Examiner, Art Unit 2823